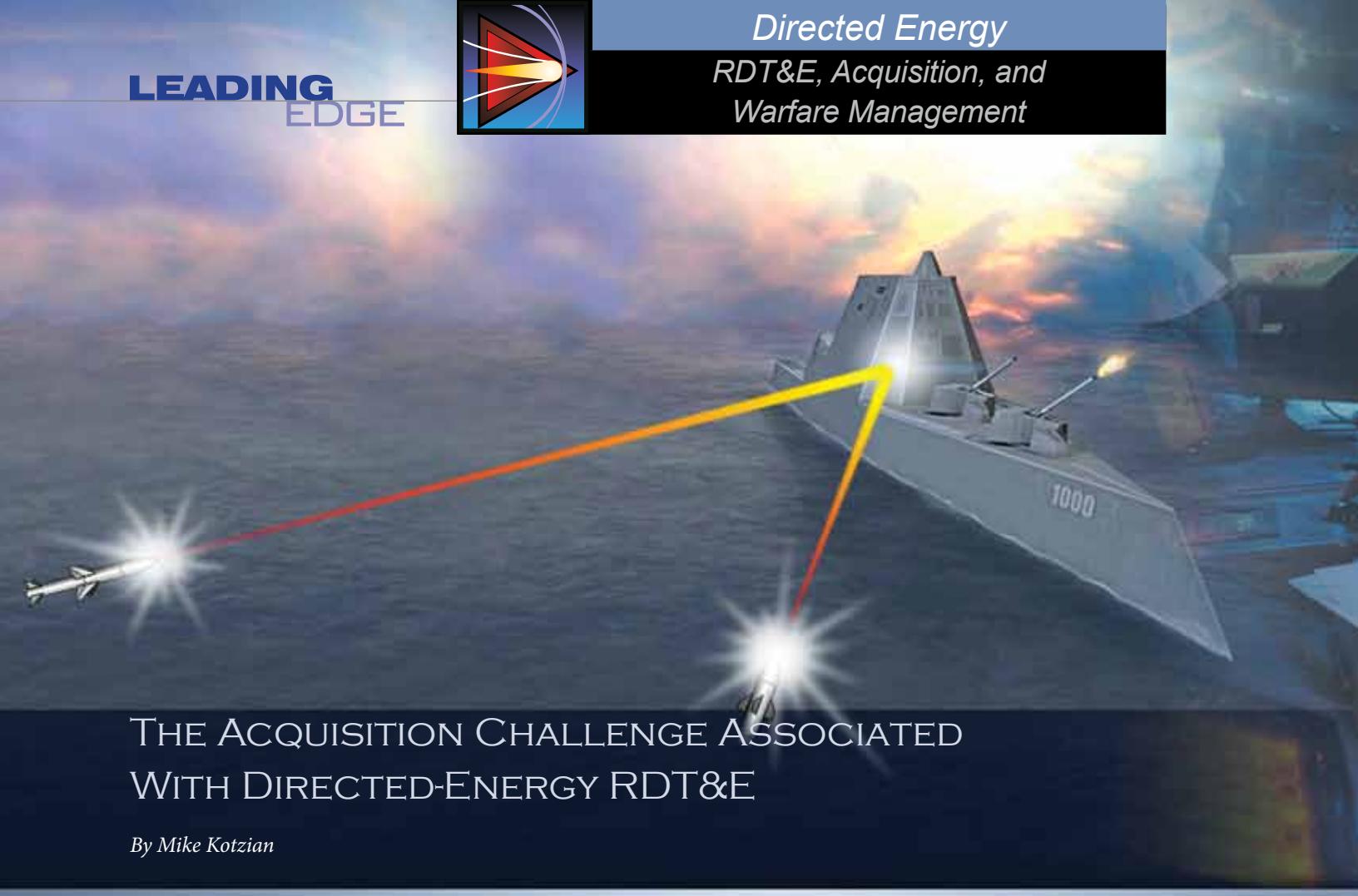

The Acquisition Challenge Associated With Directed-Energy RDT&E

By Mike Kotzian

An already tense situation quickly escalated. Everyone within the combat information center of the Navy's newest all-electric ship suddenly realized that two surface-skimming, antiship missiles were bearing down on their destroyer. With less than 30 seconds to impact, the tactical warfare officer gave the order to fire. Seconds later, the first surface-skimming missile vanished from all tracking consoles. Another order to fire closely followed, and the second missile threat was also destroyed. Consequently, within a matter of 10 seconds from threat recognition to threat elimination, the Navy's newest all-electric ship was able to destroy two incoming threats by using one of the Navy's newest weapon systems—the free-electron laser.

Does this scenario of a Navy all-electric ship, employing a high-energy laser to shoot down enemy surface-skimming antiship missiles, sound like inevitable reality or unattainable science fiction? For scientists and engineers working on directed-energy systems for the Navy, the answer does not lie solely in the advanced technical challenges associated with developing directed-energy weapons. Rather, the answer also lies in how well scientists and engineers understand and adhere to the Department of Defense's (DoD's) Defense Acquisition Management System (DAMS) framework governing the development of new weapon systems.

Evolution of Defense Acquisition

The way in which DoD identifies needs and subsequently develops, tests, procures, and sustains weapon systems has evolved over time. Today's acquisition foundation can be traced back to the Packard Commission report in 1986, where many of this report's recommendations became part of the Goldwater-Nichols DoD Reorganization Act of 1986. This evolution continued along three tracks:

1. Requirements moving from threat-based to capability-based
2. The resource allocation system adding execution reviews with concurrent program and budget reviews

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
2012		**00-00-2012 to 00-00-2012**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
The Acquisition Challenge Associated with Directed-Energy RDT&E	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Naval Surface Warfare Center, Dahlgren Division,Corporate Communication, C6,6149 Welsh Road, Suite 239,Dahlgren,VA,22448-5130**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
See also ADA556728.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**6**	

3. The acquisition process attempting to incorporate a more flexible and tailored process

These three tracks form the Defense Support System organizational structure: the Joint Capabilities Integration and Development System (JCIDS) process; the Planning, Programming, Budgeting, and Execution (PPBE) process; and the DAMS process, respectively. These three processes operate as "systems of systems" and are referred to as the "Big A" acquisition process shown in Figure 1.[1]

While all three of these phases hold their own level of importance, the major focus for scientists and engineers at research and development (R&D) facilities is the "Little a" acquisition process. It is this "Little a" acquisition process, where the rules and processes are found, that governs how DoD goes about developing a new materiel solution to a validated warfighter requirement. These rules and processes are codified within DoD Instruction 5000.02, *Operation of the Defense Acquisition System*, which was issued in December 2008.

The acquisition framework associated with DoD Instruction 5000.02 is the DAMS structure. This framework, shown in Figure 2, consists of numerous strategically placed milestones and major program reviews to ensure proper programmatic oversight.[2] Each of the milestones has specific

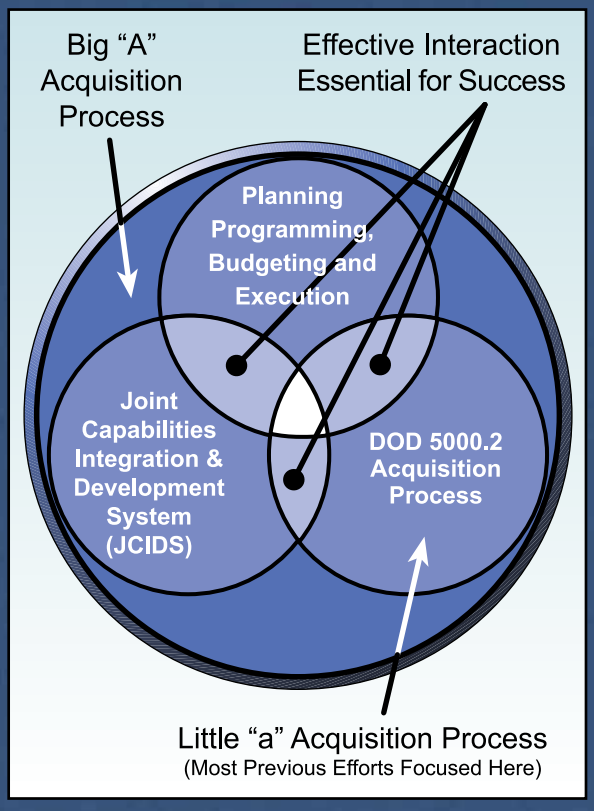

Figure 1. Defense Support System Organizational Structure

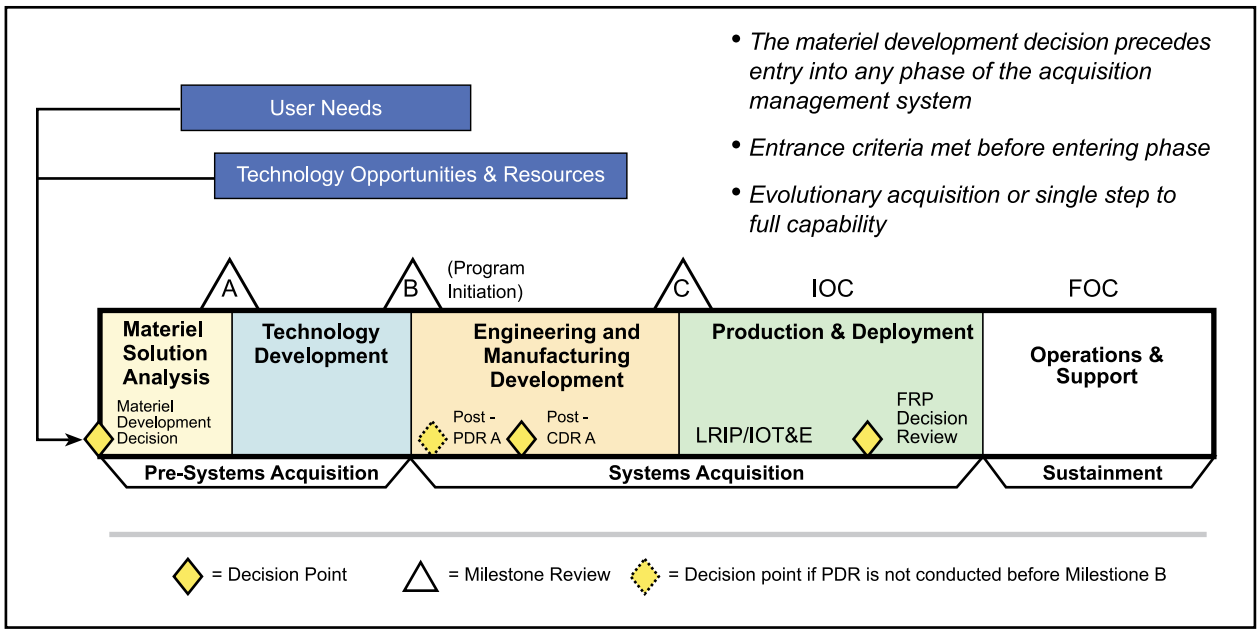

Figure 2. DoD Acquisition Framework

criteria that must be satisfied before a program is allowed to further proceed along the DAMS. The program's Milestone Decision Authority (MDA) rests with the individual responsible for deciding if the milestone criteria have been met and, if so, for allowing the program to proceed to the next phase of the acquisition process. Designation of a program's MDA depends on a program's level of research, development, test, and evaluation (RDT&E) and procurement funding. For example, an Acquisition Category (ACAT) I program is defined as an eventual total expenditure for RDT&E of more than $365 million in fiscal year (FY) 2000 constant dollars or, for procurement, of more than $2.19 billion in FY 2000 constant dollars. In this case, for an ACAT ID ("D" refers to the Defense Acquisition Board (DAB)) the Under Secretary of Defense for Acquisition, Technology and Logistics (USD(AT&L)) is the MDA; for an ACAT IC ("C" refers to Component or Service), the MDA is the Head of the DoD Component or, if delegated, the Component Acquisition Executive.[3]

In addition, civilian and military workforce members within the DoD whose job responsibilities are deemed acquisition-related find themselves with a training requirement necessary to carry out their acquisition-related job responsibilities. Specifically, these workforce members are required to gain acquisition training and education with the passage of the Defense Acquisition Workforce Improvement Act (DAWIA) signed into law in 1990. The current certification process comprises three levels covering 16 different career fields. Each of these 16 career fields has a set of specific training, education, and experience requirements that must be met in order for an individual to achieve Level 1, Level 2, or Level 3 certification. The Defense Acquisition University (DAU) provides the necessary training classes required for the certification. DAU identifies "core-plus" training classes and continuous learning modules for each level of certification. The core-plus classes and modules are not required for certification but are identified as additional sources of information to assist individuals in becoming more knowledgeable about their career field beyond the minimum standards required for certification. The most up-to-date certification frameworks for all 16 career fields can be found at the following DAU website: http://icatalog.dau.mil/onlinecatalog/CareerLvl.aspx

Defense Acquisition Reform

The DoD acquisition environment is undergoing continuous change. The issuance of DoD Instruction 5000.02 marked the opening salvo of what has become seemingly constant updates, modifications, and guidance impacting how DoD procures weapon systems to meet warfighter requirements. In addition to DoD's issuance of DoD Instruction 5000.02, the Government Accountability Office published a stream of reports and findings that indicate significant cost growth and schedule delays in major defense acquisition programs. In 2009, Secretary of Defense Robert M. Gates proclaimed

a new way of doing business within DoD when it comes to weapon systems acquisition. Pressures are building for every program to maintain cost and schedule estimates while delivering the technical requirements originally developed to support the warfighter.

Moreover, there have been two major policy issuances. As previously mentioned, the first was DoD Instruction 5000.02 in December 2008. This update of the rules and processes governing DoD weapon systems acquisition primarily impacted the early part of the DAMS framework. The problem was that weapon system programs were failing their initial operational test and evaluation phases at alarming rates—many times traced to program offices attempting to design weapon systems with immature technology. Such failures were preventing those programs from proceeding to a full-rate production decision review and, more importantly, causing a repeat of some of the DAMS framework, which translated to increased costs and delayed initial operational capability timelines.

DoD Instruction 5000.02 attempted to solve this problem with three main emphases. First, a mandatory requirement was inserted for competitive prototyping prior to program initiation at Milestone B. The intent was to ensure a competition among contractors competing for a contract award. The theory was that such a competition would reduce technical risk, validate designs, improve cost estimates, evaluate manufacturing processes, and refine requirements. Reducing technical risks was especially important because weapon system programs were expected to demonstrate a technology readiness level (TRL) of six—where the system/subsystem model or prototype is demonstrated in a relevant environment—by the time a program reached Milestone B. TRLs are categorized on a scale of 1 to 9. A TRL of 1 is the lowest level of technology readiness, where scientific research begins to be translated into applied R&D. A TRL of 9 is the highest level of technology readiness, where the actual system is proven through successful mission operations. A TRL of 6 represents a major step up in a technology's demonstrated readiness. Using TRLs enables consistent comparisons of technical maturity across different types of technologies, giving program decision makers a common benchmark to consider when assessing program risk. Note that TRLs are meant to capture a level of technical maturity, not the probability of occurrence (i.e., the likelihood of attaining a required maturity level) or the impact of not achieving a level of technical maturity.[4]

The second emphasis was on a stricter adherence to systems engineering processes and technical reviews. Too often weapon system programs were not closely following systems engineering processes or avoiding due diligence when it came to the definition of successful exit criteria for a technical review. Consequently, all technical efforts must be outlined in a program's systems engineering plan. The program manager will use the eight technical management processes—decision

analysis, technical planning, technical assessment, requirements management, risk management, configuration management, technical data management, and interface management—to manage the technical development of the system increments, including the supporting or enabling systems.[5] The program manager will use the eight technical processes—stakeholders requirements definition, requirements analysis, architectural design, implementation, integration, verification, validation, and transition—to design the system, subsystems, and components, including the supporting or enabling systems required to produce, support, operate, or dispose of a system.[6] Figure 3 provides an overlay of the new DoD Instruction 5000.02 and Secretary of the Navy (SECNAV Instruction) 5000.2D (Implementation and Operation of the Defense Acquisition System and the JCIDS), and shows the timing of specific systems engineering technical reviews as a program matures through the DAMS.

The third emphasis was a more prominent role of the MDA, starting with a mandatory requirement that all weapon system programs seeking a full or partial materiel solution must hold a Materiel Development Decision chaired by the MDA. Thus, the old Design Readiness Review was replaced with the Post-Critical Design Review Assessment chaired by the MDA. In short, the MDA was to become a more prominent figure in the oversight of a weapon system program's progress.

The second relatively recent major policy issuance was the Weapon Systems Acquisition Reform Act (WSARA) of 2009, implemented by Directive-Type Memorandum (DTM) 09-027 in December 2009. This DTM amended DoD Instruction 5000.02, the *Defense Federal Acquisition Regulation Supplement (DFARS)*, and associated business practices within the *Defense Acquisition Guidebook (DAG)*. The WSARA implementation brought about changes to policies and procedures across 13 categories. Some of the WSARA changes most relevant to the Navy directed-energy community include:

- Analysis of alternatives study guidance
- Acquisition strategies to ensure competition
- Competitive prototyping
- Developmental test and evaluation
- Systems engineering
- Preliminary design reviews
- Critical cost growth

The Acquisition Impact

So why should the directed-energy community care about these acquisition policy changes? Because these policy changes impact the community's

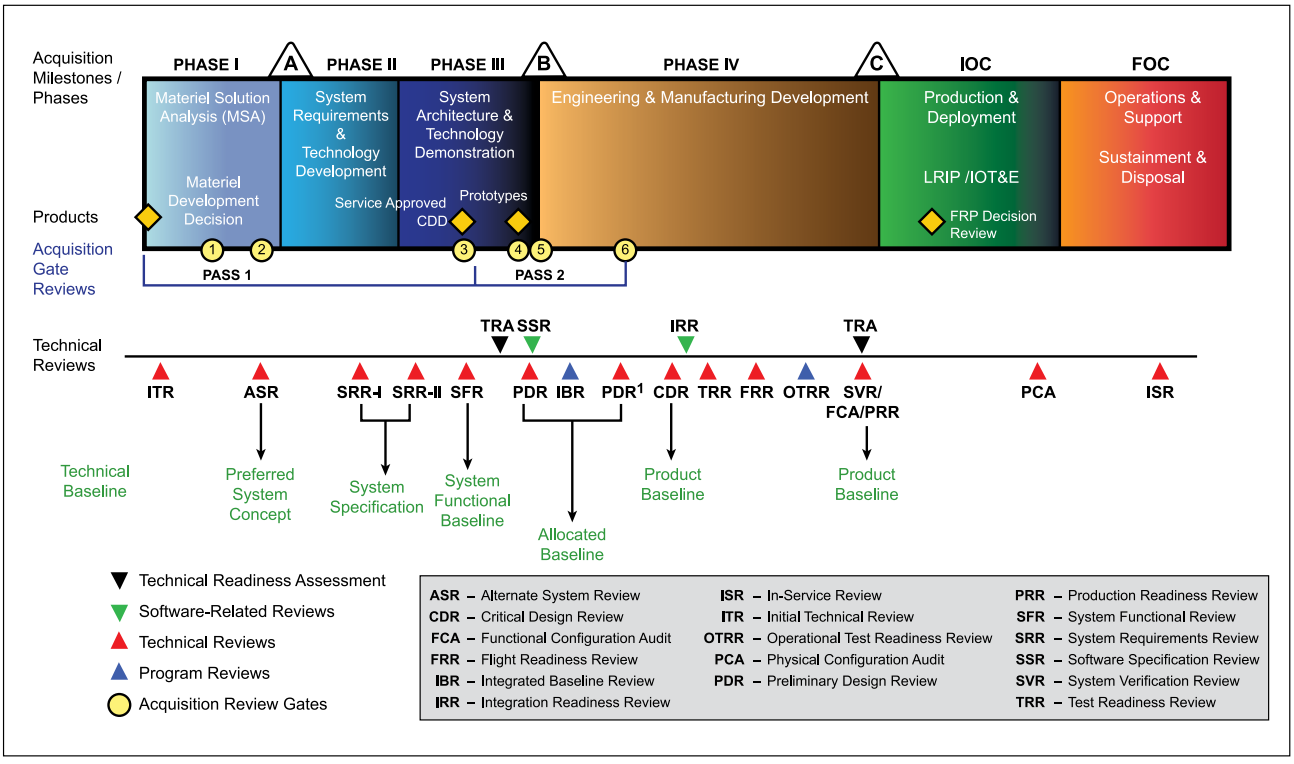

Figure 3. Systems Engineering Technical Review Timing

ability to develop, produce, and/or sustain directed-energy weapon systems. The ultimate goal of the directed-energy community is to deploy directed-energy weapons to the fleet. Accordingly, regardless of which phase or phases an organization in the community supports, its actions are impacted by the language in DoD Instruction 5000.02 and the WSARA of 2009. The more scientists and engineers in the organization are aware of governing policy documents like DoD Instruction 5000.02, the better their chances are of meeting DoD leadership's expectations in terms of cost, schedule, and technical effectiveness.

Actions have shown that DoD senior leadership has come to expect all weapon system programs to adhere to the current acquisition-related policy and guidance changes. As mentioned earlier, major weapon system programs have recently been canceled or restructured for not meeting DoD senior leadership expectations—something that rarely occurred previously. In today's environment, technology alone will not carry the argument for a program's survivability. Directed-energy weapons definitely carry the allure of a "Star Wars-like" capability, but these same weapon systems will need to show sustainable cost and schedule compliance if they are to come to fruition. Resources are too limited, and the warfighter has too many needs to allow unsustainable weapon system programs to continue. Therefore, everyone involved with the development, procurement, and/or sustainment of a directed-energy weapon system needs to have an adequate understanding of the acquisition underpinnings now governing DoD.

Summary

The proverbial "winds of change" are blowing across the DoD acquisition landscape. The management of major weapon systems dependent upon cutting-edge technologies—such as those of directed energy—cannot afford to conduct business in a manner reminiscent of bygone days. Everyone involved with the development, production, or sustainment of a directed-energy weapon system needs to understand the "rules of engagement" laid down by the most recent DoD acquisition policy guidance. Highly skilled scientists and engineers typically already understand the need for a structured systems engineering approach to problem solving. Today, though, more than ever, cost and schedule must be factored in as potential tradespace to deliver the ultimate goal: a cost-effective, directed-energy weapon system delivered in a timely manner while meeting the warfighter's requirements. Scientists and engineers who adhere to these recent acquisition changes will help their organizations achieve this goal, thereby ensuring that warfighters will be armed with the most technologically superior weapons possible.

References

1. Congressional Research Service Report 7-5700, 10 July 2009, p. 3.
2. Ibid., p. 8.
3. DoD Instruction 5000.02, 8 December 2008, p. 33.
4. *Defense Acquisition Guidebook*, 5 May 2010, paragraph 10.5.2.2.
5. Ibid., paragraph 4.2.3.1.
6. Ibid., paragraph 4.2.3.2.